REMARKS

The present application was filed on May 15, 2006 with claims 1 through 34. Claims 1 through 34 are presently pending in the above-identified patent application.

In the Office Action, the Examiner rejected claims 1-7, 10-16 and 21-25 under 35 U.S.C. §103(a) as being unpatentable over Li et al. (United States Publication No. 2004/0022174) in view of Sandell (United States Publication No. 2004/0131011), rejected claims 8, 17, 18 and 20 under 35 U.S.C. §103(a) as being unpatentable over Li et al. in view of Sandell and further in view of Joo (United States Publication No. 2004/0208253), and rejected claims 9 and 19 under 35 U.S.C. §103(a) as being unpatentable over Li et al. in view of Sandell and further in view of well know prior art (MPEP 2144.03).

Independent claims 1, 17, 21, 26, 29, 31 and 33

Independent claims 1, 21, 26, 29, 31 and 33 were rejected under 35 U.S.C. §103(a) as being unpatentable over Li et al. in view of Sandell, and independent claim 17 was rejected under 35 U.S.C. §103(a) as being unpatentable over Li et al. in view of Sandell and further in view of Joo. Regarding claim 1, the Examiner asserts that Li discloses diagonally loading subcarriers from said one or more symbols (paragraphs 46 and 4; and FIGS. 1-4).

Applicants note that, in the text cited by the Examiner, Li teaches:

> [0046] Thus, as shown in FIG. 3A, the first transmitter transmits symbols during the short-training period 310 in accordance with the IEEE 5 GHz standard. Once the short-training symbols have been transmitted, long-training symbols X 355a and X 365a are transmitted during the long-training period 320. Here, the capital symbol X denotes a set of the frequency domain quantities in an orthogonal frequency division multiplexing (OFDM) system. Thus, X can be viewed as a vector containing N elements, where N is the number of sub-carriers in the OFDM system. Each element X(k) of X is carried by its corresponding kth sub-carrier. It should be appreciated that X is inverse Fourier transformed to a time domain signal, added with a cyclic prefix, and converted to a radio-frequency (RF) analog signal by an RF module prior to being radiated from a transmit antenna.

Li teaches the transmission of short-training symbols and long-training symbols; Li makes *no* reference to diagonal loading. Furthermore, paragraph [0041] of Sandell is directed to *a diagonal channel matrix to estimate a channel impulse response;* Sandell does *not* disclose or suggest *diagonally loading subcarriers*. Independent claims 1 and 21 require *diagonally loading subcarriers from said one or more symbols across a plurality of antennas* in said multiple antenna wireless communication system. Independent claim 17 requires *diagonally*

loading subcarriers from a single-antenna long training symbol across long training symbols associated with logically adjacent antennas in said multiple antenna wireless communication system; nulling subcarriers in said plurality of long training symbols that are not diagonally loaded; and inserting at least one additional subcarrier to ensure that a nulled subcarrier has at least one subcarrier located on each side of said nulled subcarrier. Independent claims 26 and 29 require transmitting subcarriers from said one or more symbols using a plurality of antennas in said multiple antenna wireless communication system *such that each of said subcarriers are active on only one of said plurality of antennas at a given time.* Independent claims 31 and 33 require aggregating subcarriers from said one or more symbols that were transmitted such that *each of said subcarriers are active on only one of said plurality of antennas at a given time.*

In the Response to Arguments section of the final Office Action, the Examiner asserts that the diagonal loading of symbols is inherent in OFDM channels and the diagonal loading of symbols across multiple antennas is inherent in a MIMO-OFDM channel. In evidence of the allegation that an OFDM channel loads data symbols diagonally, the Examiner asserts that chapter 3 of Tse, particularly section 3.4.4, teaches that smaller portions of the input data are interleaved across the transmit and receive antennas. The Examiner asserts that the inherent interleaving function of OFDM is equivalent to diagonal loading of the claimed limitation.

Applicants note that Tse describes the cited interleaving function in section 3.2 and, in particular, FIG. 3.5. As shown in FIG. 3.5, each portion of each codeword x_0-x_3 is interleaved such that each of the four portions of codeword x_0 reside in each of the first locations of the four interleaved codewords. Similarly, each of the four portions of codeword x_1 reside in each of the second locations of the four interleaved codewords, each of the four portions of codeword x_2 reside in each of the third locations of the four interleaved codewords, and each of the fourth portions of codeword x_3 reside in each of the last locations of the four interleaved codewords. Thus, while the codewords are interleaved, they are <u>not</u> *diagonally loaded*; diagonally loading would result in a portion of each codeword residing in a different location in each interleaved codeword, i.e., for example, a first portion of x_1 would reside in a *first* location of a first interleaved codeword, a second portion of x_1 would reside in a *second* location of a second interleaved codeword, and so on. (See, FIG. 4 and the associated text of the present disclosure.)

In the Response to Arguments section of the final Office Action, the Examiner further refers applicant to the reference Terable et al., particularly paragraph [0119], in providing evidence that interleaving (alleged to be equivalent to diagonal loading) is inherent in OFDM.

In the text cited by the Examiner, Terable teaches:

> [0119]The interleaver 132b conducts interleaving inherent to the OFDM transmitter T0, for the encoding result of the channel encoder 131 to make the data signal have the orthogonality to the other OFDM transmitters T1 and T2. The scheduling unit 110 outputs the inherent interleaving pattern information to the subcarrier allocating unit 160 to notify the OFDM receiver R0 of the information.

As argued above, while diagonal loading is a type of interleaving, interleaving is *not* equivalent to diagonal loading. Terable does *not* disclose or suggest *diagonal loading*.

In the Response to Arguments section of the final Office Action, the Examiner further asserts that Sandell teaches a MIMO-OFDM system that displays multiple streams (sub-carriers) found between multiple input and multiple output antennas (paragraphs [0098]-[0108] and FIG. 5).

Applicants note that, in the text cited by the Examiner, Sandell teaches, for example, a channel parameter estimator 600. Sandell does *not* disclose or suggest *diagonal loading*. Furthermore, the Examiner's assertion that multiple streams are equivalent to subcarriers is *not* correct. In a MIMO-OFDM system, the streams are spatially-multiplexed data streams, each consisting of multiple subcarriers, i.e., spatial data streams and OFDM subcarriers are two different entities, as would be apparent to a person of ordinary skill in the art.

In the Response to Arguments section of the final Office Action, the Examiner further asserts that, since the D matrix is diagonal, where each diagonal element of the matrix is a sub-carrier, the input data are loaded into the sub-carriers diagonally.

Applicants note that each of the "diagonal" elements in the D matrix corresponds to a spatially-multiplexed data stream and does *not* indicate a diagonal loading of subcarriers, i.e., with SVD, the input data are *not* loaded onto the subcarriers diagonally. SVD has *no* relationship to diagonally loaded subcarriers as all subcarriers for each spatial substream are loaded into the same element of D, as would be apparent to a person of ordinary skill in the art.

Thus, Li et al., Sandell, and Joo, alone or in combination, do not disclose or suggest diagonally loading subcarriers from said one or more symbols across a plurality of antennas in said multiple antenna wireless communication system, as required by independent claims 1 and 21, do not disclose or suggest diagonally loading subcarriers from a single-antenna

long training symbol across long training symbols associated with logically adjacent antennas in said multiple antenna wireless communication system; nulling subcarriers in said plurality of long training symbols that are not diagonally loaded; and inserting at least one additional subcarrier to ensure that a nulled subcarrier has at least one subcarrier located on each side of said nulled subcarrier, as required by independent claim 17, do not disclose or suggest transmitting subcarriers from said one or more symbols using a plurality of antennas in said multiple antenna wireless communication system such that each of said subcarriers are active on only one of said plurality of antennas at a given time, as required by independent claims 26 and 29, and do not disclose or suggest aggregating subcarriers from said one or more symbols that were transmitted such that each of said subcarriers are active on only one of said plurality of antennas at a given time, as required by independent claims 31 and 33.

Dependent Claims 2-16, 18-20, 22-25, 27-28, 30, 32 and 34

Claims 2-16, 18-20, 22-25, 27-28, 30, 32 and 34 are dependent on independent claims 1, 21, 26, 29, 31 and 33, and are therefore patentably distinguished over Li et al., Sandell, and Joo, alone or in combination, because of their dependency from independent claims 1, 17, 21, 26, 29, 31 and 33 for the reasons set forth above, as well as other elements these claims add in combination to their base claim.

Conclusion

All of the pending claims, i.e., claims 1-34, are in condition for allowance and such favorable action is earnestly solicited.

If any outstanding issues remain, or if the Examiner has any further suggestions for expediting allowance of this application, the Examiner is invited to contact the undersigned at the telephone number indicated below.

The Examiner's attention to this matter is appreciated.

Respectfully submitted,

/Kevin M. Mason/

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Kevin M. Mason
Attorney for Applicants
Reg. No. 36,597
Ryan, Mason & Lewis, LLP
1300 Post Road, Suite 205
Fairfield, CT 06824
(203) 255-6560